

**EARTH AND SPACE SCIENCES**  
**431 PRINCIPLES OF GLACIOLOGY**  
**505 THE CRYOSPHERE**

**Autumn 2018**  
4 Credits, SLN 14855  
4 Credits, SLN 14871

M-W-F, 1:30 - 2:50 pm. **Room:** JHN 127  
Mon.-Wed.: Lectures, Fri: Lab/Discussion

**Week 1 –**

W, 09/26 Unit 1	<b>Natural Occurrences of Ice:</b> Distribution and environmental factors of seasonal snow, sea ice, glaciers and permafrost	Christianson
F, 09/28	<i>Lab/Discussion – No Class</i>	

**Week 2 –**

M, 10/01 Unit 1	<b>Measuring Occurrences of Ice:</b> Observational techniques that help us understand the extent of the cryosphere	Christianson
W, 10/03 Unit 2	<b>Physical Properties of Ice:</b> Phase relationships, crystallography, basic properties	Christianson
F, 10/05	<i>Lab/Discussion</i>	Christianson/Horlings

**Week 3 –**

M, 10/08 Unit 2	<b>Snow:</b> Formation in the atmosphere	Christianson
W, 10/10 Unit 2	<b>Accumulation:</b> Snow deposition, wind transport, metamorphism, physical properties	Horlings
F, 10/12	<i>Lab/Discussion</i>	Christianson/Horlings

<b>Field Trip, Saturday, 10/13 - Mt. Baker</b>
--

**Week 4 –**

M, 10/15 Unit 3	<b>Ablation:</b> Mass and energy budgets in the cryosphere	Christianson
W, 10/17 Unit 3	<b>Glacier Dynamics I:</b> Ice deformation	Fudge
F, 10/19	<i>Lab/Discussion</i>	Waddington/Lilien

**Week 5 –**

M, 10/22 Unit 3	<b>Glacier Dynamics II:</b> Sliding of glaciers and glacier basal processes	Christianson
W, 10/24 Unit 3	<b>Glacier Dynamics III:</b> Temperature and heat flow in ice masses	Hills
F, 10/26	<i>Lab/Discussion</i>	Christianson/Hills/ Horlings

**Week 6 –**

M, 10/29 Unit 4	<b>Glacier Variations:</b> Response of glaciers to climate changes	Christian
W, 10/31 Unit 4	<b>Ice Sheets, Ice Streams, Ice Shelves:</b> Ice-sheet structure and characteristics, ice-stream flow, ice shelves, and ice–ocean interactions	Christianson
F, 11/02	<i>Lab/Discussion</i>	Christianson/Christian/ Horlings

**Week 7 –**

M, 11/05 Unit 4	<b>Glacier Instabilities:</b> Surging glaciers, tidewater glacier cycles, marine ice-sheet and ice-cliff instabilities	Christianson
W, 11/07 Unit 4	<b>Recent Changes in Ice Sheets:</b> Elevation changes, retreat of ice shelves, speedup of outlet glaciers, sea-level change	Christianson
F, 11/09	<b>MIDTERM EXAM</b>	Horlings

**Week 8 –**

M, 11/12	[VETERANS DAY]	
W, 11/14	<b>Midterm Review/Discussion and Glacier Instabilities</b>	Christianson
F, 11/16	<b>Paleoclimate and Ice Ages I:</b> Ice cores and past climate	Christianson

**Week 9 –**

M, 11/29	<b>Paleoclimate and Ice Ages II:</b> Theories of ice-age cycles	Christianson
W, 11/21	<i>Lab/Discussion</i>	Christianson
F, 11/23	[THANKSGIVING]	

**Week 10 –**

M, 11/26	<b>Sea Ice I:</b> Formation, structure, and relation to the climate	Light
W, 11/28	<b>Sea Ice II:</b> Dynamics and thermodynamics	Light
F, 11/30	<i>Lab/Discussion</i>	Light/Horlings

**Week 11 –**

M, 12/03	<b>Glacial Erosion:</b> Abrasion, quarrying, subglacial fluvial processes, and chemical denudation	Hallet
W, 12/05	<b>Permafrost:</b> Distribution, relationship to climate, physical processes and structure/engineering problems	Hallet
F, 12/07	<i>Graduate Student Presentations</i>	Waddington

**FINAL EXAM**

**Monday, December 10th 2:30-4:20**